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PROGRESS REPORT

PERIOD OF 1 JULY 1965 TO 31 JULY 1965

CONTRACT NUMBER AF33(600)40280

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BY

WESTINGHOUSE ELECTRIC CORPORATION

AEROSPACE DIVISION

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SPECIAL HANDLING

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A F-101 FLIGHT TEST

FLIGHT TESTS

Three missions were flown during July, as summarized in Table I. Specific data on each flight is given in Appendix A. During flight 176 a valve in the air conditioning system failed, causing cockpit overheating and failures in aircraft instruments, the APN-102 doppler navigator, a recorder transistor, and a decrease in the transmitter TWT current pulse.

The Air Force team from Hill AFB, Utah, spent the last three weeks in July performing the mandatory Tech Orders. The work was 98% complete by the end of July. Aircraft down time was used to perform repairs and preventive maintenance and to incorporate modifications.

TABLE I

F-101 PROGRAM SUMMARY
July 1965

Flights Scheduled		4
Flights Accomplished		3
Radar	3	
Flights Cancelled		1
Transmitter	1	
In-flight Failures		1
Transmitter and Recorder because of Aircraft Air-Conditioning failure	1	

MODIFICATIONS AND GROUND TESTS

Transmitter

Replacing the thyratron and a capacitor repaired transmitter 001. Installed in the F-101 in place of the breadboard unit, this transmitter generated a 30 nano-second pulse at 80 watts average power.

Receiver

During the aircraft down-time, the receiving TWT was replaced. Performance of the two units tested as follows:

	Gain	Noise Figure
Original Unit	28 db	12.1 db
New Unit	36 db	7.2 db

After adjustment and re-tuning of the parametric amplifier in the laboratory, the par amp gain measured 17 db, with a 3.6 db noise figure and 210 megaHertz bandwidth. System noise figure of the readjusted paramp and new TWT is 5.2 db.

Recorder

Two modifications to the recorder film drive have been made. First, a microswitch was added to sense any film set in the take-up loop and increase the voltage to the take-up loop roller motor. Second, a potentiometer was added to the feed and take-up torque motor circuitry to allow easier adjustment for a desired drive ratio, particularly when changing film types. In addition, drag and idler roller spacing and parallelism were checked and adjusted.

Difficulties in obtaining repeatable recorder CRT-film transfer characteristics caused tighter controls to be implemented in the recorder and Versamat procedures, including one hour warm-up of the Versamat to stabilize the chemical temperature.

The following procedure was set-up to establish receiver and recorder operating conditions:

1. Select recorder aperture and film developing speed to give maximum linearity and change in transmission from the CRT-film bias vs film transmission curve.
2. Set CRT bias to give 50% transmission.
3. For low altitude flights, set the peak-to-peak noise level to give twice the voltage necessary to obtain change from 50 to 65% in transmission.
4. Adjust peak-to-peak limited video to give 2.5 times the voltage necessary to cause change from 50 to 95% in transmission.
5. Compensate for changes in transmitted power or altitude by changing either RF or IF gain.

Antenna

Azimuth and elevation patterns taken on the antenna range were in close agreement with the original measurements.

B SYSTEM

RECORDER

Following flight testing of the breadboard, the extensive modifications to provide higher reliability and faster switching in the flip-flop circuits have been started on the two remaining electronic packages.

ANTENNA

Tests on the bonding of antenna sticks with heat and pressure at Westinghouse Research Labs have met with limited success. One stick accumulated over 200 hours at 550°F and 30 psig without measurable leakage; one stick leaked after 16 hours; tests on a third stick were discontinued after 5 hours without failure. These tests have directed the continuing effort at Aerospace, where the reworking of antennas will be done.

The wet-overlay bonding has been abandoned because of excessive porosity of the fabric and the formation of bubbles.

Several conclusions have been drawn from tests at Aerospace. The I40 and I60 resins bond equally well without bubbles; failures with the two resins have been identical. Bonding can be accomplished with the I8 coated fabric. No perforations in the fabric are required to eliminate bubbles. Spraying the fabric without using a silk screen mask causes no detectable RF deterioration; thus the mask can be eliminated.

Spots of poor adhesion remain the major problem. Various cleaning processes have caused similar results.

MODIFICATIONS

Minor modifications continue to be incorporated in the three systems. The more important of these modifications are reviewed.

Modification	Systems		Spares	
	Complete	In Work	Complete	In Work
Video Amp, Increase Bandwidth	3	-	1	-
Control Panel, Second Failure Determination	3	-	1	-
Frequency Generator, Temperature Stability, Delayed Turn On, etc.	3	-	1	-
Frequency Generator, Oscillator	3	-	2	-
Transmitter, TWT Filament Supply	2	1	N/A	
Range Mark Selector	2	-	N/A	
Recorder, Inverter Focus Power Supply Torque Motor Inverter Low Frequency Cut Out	3	-	N/A	
Recorder, Flip-Flop Redesign	1	2	N/A	
Recorder, Blanking Change	1	2	N/A	
Recorder, Loop Motor Increased Gain	3	-	N/A	
Recorder, Additional loop switch	1	2	N/A	
Recorder, Capstan Drive motor Change (F-101 only)	1	-	N/A	
Low Noise Pre-Amplifier (Par Amp)	1	2	0	1
Nav Tie-In, Integrator gain Change	3	-	1	1
Frame, Deletion of Nav Data Recorder	2	-	N/A	

RELIABILITY

Failures are reported for all systems, from which Mean-Time-Between-Failure is periodically calculated.

Figure 1 showing the MTBF for system 002 and the F-101 system indicates that the reliability has recently been stable. System 003 has not operated as a system since being returned to Aerospace; time and failures on units from that system are included with system 002. Composite MTBF for the two systems since February 1964 is:

	MTBF (hours)
F-101 System	23.6
System 002	9.3
Both systems	16.3

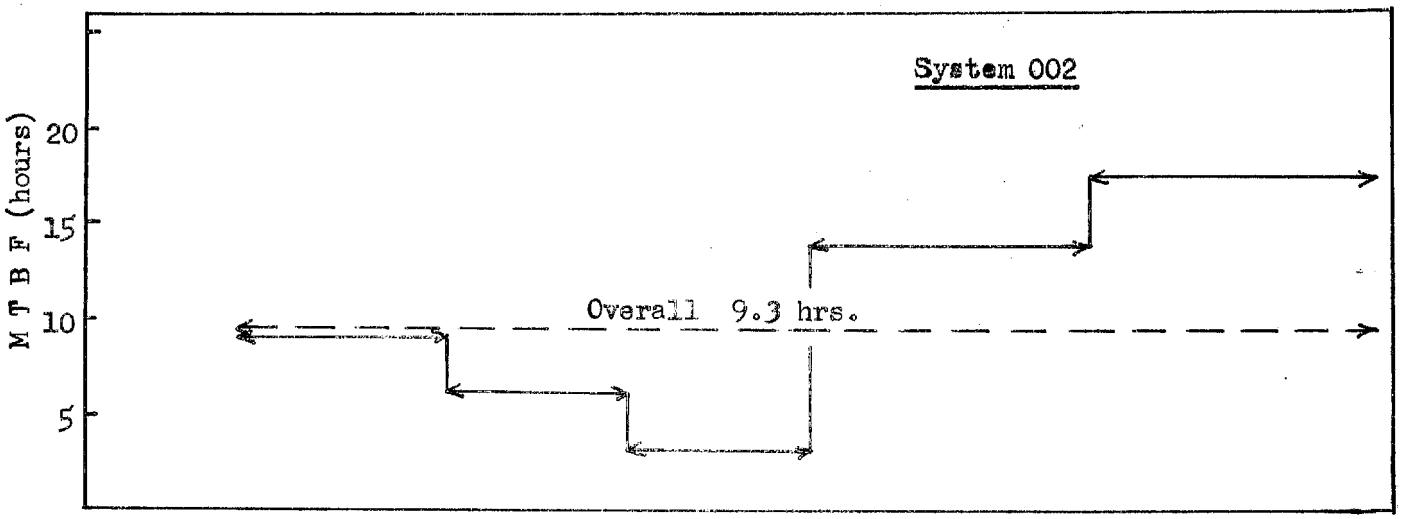
C SPARES

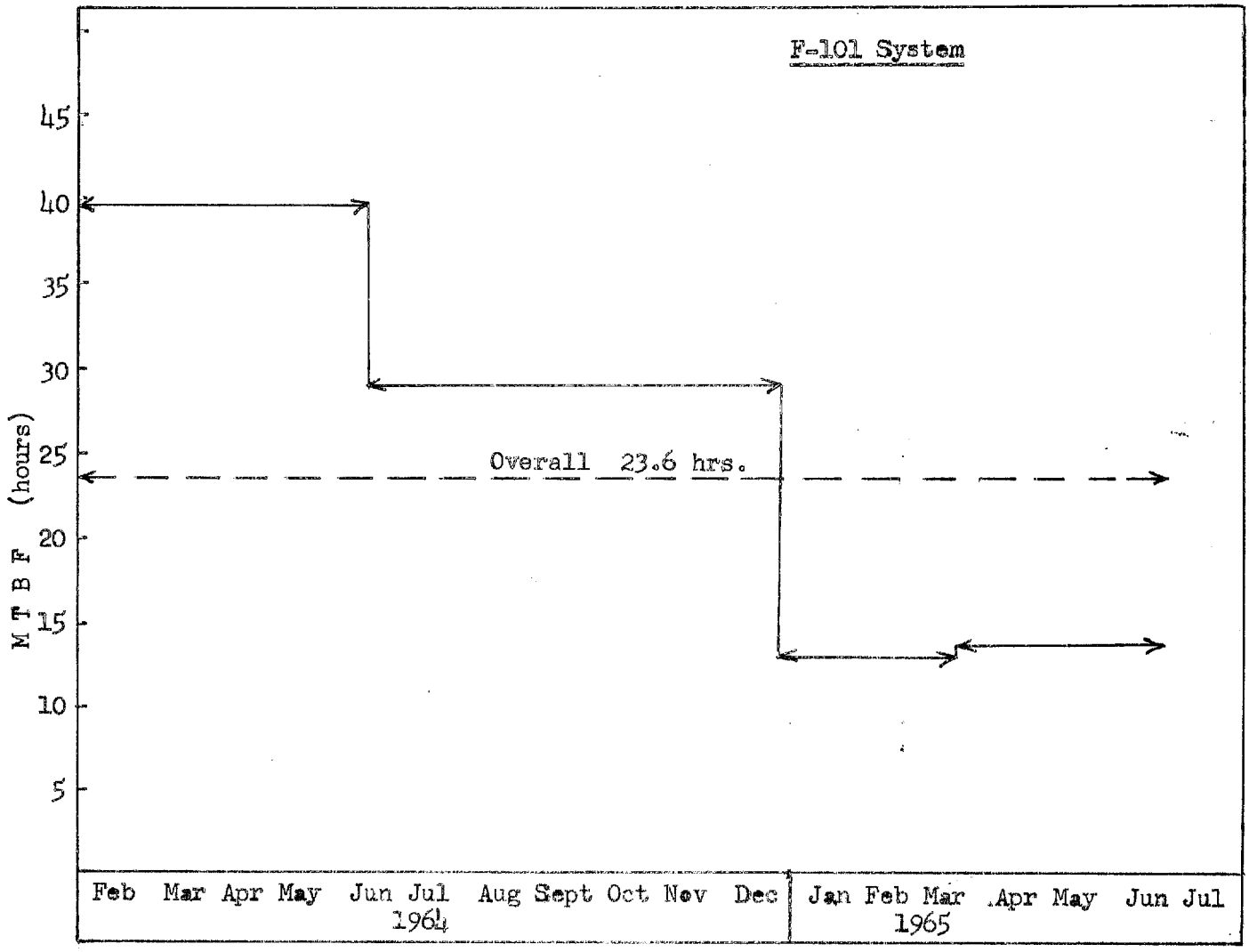
No spares have been added to either system or ground support equipment spares. Status of spares is as follows:

System	Items Shipped in July	Items Open	Per Cent Complete
System	1	14	99
Basic list plus first 10 amendments	1	8	99
Amendment 11 (remains open)	0	6	--
Ground Support Equipment	0	1	99

FIGURE 1

SOARD SYSTEM RELIABILITY





D CORRELATOR OPERATION

A diverger for the laser on the Detail Correlator has been ordered but not yet received. Achromatic cylinder lenses for enlarging have been received and their mounts made. They will be installed after the diverger has been received.

An Automatic Dodging Contact Printer, Log-E-Tronics Model CP18A, has been received as GFE and set-up. Work has been done on output films and enlarged sections to determine proper exposure, dodging factors, and choice of films and papers. Various developers and procedures are being tried to obtain the optimum development procedure.

E CORRELATOR MECHANICAL REVIEW

Investigations for the correlator mechanical review are complete. Writing of the memorandum has started.

APPENDIX A - TABLE OF FLIGHTS

FLIGHT NO.	174	175	176
DATE	7-7-65	7-9-65	7-9-65
ALTITUDE	21,500	21,500	21,500
AREA	Aberdeen Proving Ground	Baltimore Harbor	Baltimore Harbor
PURPOSES	After-burner test and pattern of military targets.	Target Signature	Target Signature
SIGNIFICANT SYSTEM CHANGES	Breadboard Transmitter replaced transmitter 001; recorder 005 replaced 006.	None	None
RESULTS	Map is best from 1/4 to 3/4 range. Contrast & resolution(18-24 ft.) are good in best areas. Most of the military targets in specified pattern were discernible. Map density still low over near 1/5 range. Density striations due to DFT gate viewing water.	In best areas, resolution and contrast comparable to 174. Sensitivity of very small targets in water such as small buoys, piling clusters, etc. was very good. Ship channels marked by buoys easily traced. Several good presentations of freighters obtained, particularly with Detail Correlator. Programmed 5° LWD roll caused fading boundary at 1/4 range. Loose DFT tracking.	